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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF: Akira TAMATANI, et al.

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EXAMINER: JEANNE A. DI GRAZIO

FOR: LIQUID CRYSTAL DISPLAY DEVICE AND METHOD FOR MANUFACTURING THE SAME

INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR 1.97

ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

SIR:

Applicant(s) wish to disclose the following information.

REFERENCES

- ☒ The applicant(s) wish to make of record the references listed on the attached form PTO-1449. Copies of the listed references are attached, where required, as are either statements of relevancy or any readily available English translations of pertinent portions of any non-English language references.
- ☒ A check is attached in the amount required under 37 CFR §1.17(p).

RELATED CASES

- ☐ Attached is a list of applicant's pending application(s) or issued patent(s) which may be related to the present application. A copy of the patent(s), together with a copy of the claims and drawings of the pending application(s) is attached along with PTO 1449.
- ☐ A check is attached in the amount required under 37 CFR §1.17(p).

CERTIFICATION

- ☐ Each item of information contained in this information disclosure statement was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this statement.
- ☐ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application or, to the knowledge of the undersigned, having made reasonable inquiry, was known to any individual designated in 37 CFR §1.56(c) more than three months prior to the filing of this statement.

DEPOSIT ACCOUNT

- ☒ Please charge any additional fees for the papers being filed herewith and for which no check is enclosed herewith, or credit any overpayment to deposit account number 15-0030. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

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STATEMENT OF RELEVANCY**Reference AÖ (JP 10-142610) on Form 1449:**

The publication discloses a liquid crystal device including a liquid crystal layer between a pair of substrates, wherein column-shaped spacers are disposed for controlling a gap between the pair of substrates, each of the column-shaped spacers has a portion for substantially controlling the gap between the pair of substrates and a portion for reflecting or absorbing visible light, and the portion for reflecting or absorbing visible light is located at an interface between the spacer and at least one of the pair of substrates.

Reference AP (JP 2000-66163) on Form 1449:

The invention of this publication aims to improve the uniformity in a gap plane, gap accuracy and alignment accuracy and to provide a liquid crystal display element which is capable of making high-grade display by executing the alignment and gap control of a pair of substrates with the same stage.

In the method of this invention, the substrate bonding device has a pair of upper and lower surface plates 9, 10 and a recognition camera (not shown in Fig.) within a vacuum vessel 8. The substrate 2a dropped with liquid crystal installed on the lower surface plate 10 and the other substrate 2b is attracted to an electrostatic chuck 11 disposed on the upper surface plate 9. The inside of the vacuum vessel 8 is maintained under a prescribed pressure and while the upper and lower plates 9, 10 are pressurized the substrates 2a, 2b are bonded and the

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markers previously formed on the substrates 2a, 2b are aligned. The inside of the vacuum vessel 8 is then restored to the atmospheric pressure. Only the sealing material between both substrates 2a and 2b is thereafter irradiated with UV rays.

The publication describes, in column [0054], "The number (density) of projections 12 is preferably large from a viewpoint of improvement of uniformity of cell gaps. On the other hand, from a viewpoint of reliability, the number (density) of projections 12 is not preferably large since bubbles would generate on the basis of relationship between a volume within the cell and expansion coefficient of material for liquid crystal when at a low temperature of not more than 0°C if the number (density) of projections 12 is large."

Reference AQ (JP 63-109420) on Form 1449:

The invention of this publication aims to form an extremely thin cell gap under control and to reduce the variance of cell thickness by holding plastic spacers between two bases, and while monitoring the cell thickness, pressing the bases.

In the method of this invention, transparent electrodes 2 and an orientation film 3 are successively formed on the surface of a base 1 and plastic spacers 5 having grain size partially or totally larger than the cell gap of a prescribed liquid crystal layer of a liquid crystal element to be produced are sprayed to the surface of the film 3. Seal agents 6 are formed on the peripheries of the base 1 and a base 1' is superposed to the plastic spacer 5 so that the plastic spacer are held between the two bases 1, 1'. When the two bases 1, 1' are pressed from respective

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outsides with loading, the plastic spacers 5 having large grain size are pressed and deformed, so that the cell gap 4 of the prescribed liquid crystal layer can be formed. When ferroelectric liquid crystal is injected into the formed liquid crystal cell by a normal method, a liquid crystal element can be obtained.

Reference AR (JP 10-104642) on Form 1449:

The invention of this publication aims to obtain a liquid crystal panel which obviates the occurrence of a sealing error, has the excellent uniformity of the gap between substrates and is strong to an external press without the occurrence of display unevenness by applying a sealing resin near a liquid crystal injection port while maintaining a liquid crystal extruding pressure, then dropping the pressure down to a resin withdrawing pressure.

In the method of this invention, a pair of the substrates 1 injected with the liquid crystal 4 are held by pressure sealing jigs and the substrate 1 surfaces are pressurized under the prescribed pressure and are held for a specified time in order to discharge the excessively injected liquid crystals 4. Next, the pressure in the pressure sealing jigs is slightly dropped to withdraw the sealing resin 8 into the liquid crystal injection port 6 and is held for the specified time, by which the sealing resin 8 is cured. The pressurizing force to the substrates 1 after the liquid crystal injection is set in two stages; the liquid crystal extruding pressure and the resin withdrawing pressure lower than the pressure. The sealing resin 8 applied near the liquid crystal injection port 6 is withdrawn to the liquid crystal injection port 6 by the difference in the pressures and is then cured and, therefore, the sealing error is prevented.

STATEMENT OF RELEVANCY**Reference AS (JP 1-114823) on Form 1449:**

The invention of this publication aims to provide a complete sealing of liquid crystal. In the method of this invention, liquid crystal is injected into a liquid crystal cell including a pair of substrates with electrodes under vacuum and at a room temperature without giving pressure to the liquid crystal, and the liquid crystal cell is pressed by a pressing body under a heated condition. Then, the heated and pressed condition is maintained for a predetermined time of period.